UNPUBLISHED PRELIMINARY DATA

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Laboratory for monitoring bacterial contamination of space components (NASA).

1. Microbiological tests were continued in four industrial clean rooms and manufacturing areas in Phoenix. In addition to air and surface samplings, quantitative and qualitative studies were made on the accumulation and subsequent survival of airborne microorganisms on stainless steel strips.

In general, the results show that the chief sources of microbiological contamination are persons working in clean rooms. The levels of contamination, both in the intramural air and on bench top surfaces, increased proportionately with personnel density and activity. Most of the contaminants were those indigenous to humans. Aerobic sporeformers, which obviously are of concern in sterilizing spacecraft, were at low levels in the air and on surfaces. Shoe cleaning with an automatic machine in the entry area of one clean room (C) produced levels of airborne contamination twenty times higher than in the clean room.

One of the areas studied contained three laminar flow work stations located at one end of the clean room. The level of airborne contamination was progressively higher the farther the sampling site was from the laminar flow work station. When no personnel were present in the immediate area of the laminar flow work station, no microorganisms could be detected. This observation contrasted with results from studies in other clean rooms that showed various levels of "background" contamination even in the absence of personnel.

The predominant microorganisms found to accumulate on stainless steel strips exposed to the intramural air of one clean room (A) were sporeformers (Bacillus spp.), molds, and actinomycetes. Similar studies in another clean room (B), where the environment is controlled more rigorously than clean room A, showed that Staphyloccocus spp. and Micrococcus spp. were the predominant contaminants. The comparative levels of contamination in both rooms, however, were approximately the same. These results point out that quantitative data alone do not reflect adequately different degrees of environmental control in clean rooms.

In clean room A, a maximal level of aerobic mesophilic microorganisms that accumulated on stainless steel strips was reached after 9 to 12 weeks of exposure. Other investigators have referred to this efeect as the "plateau phenomenon." This effect did not occur, however, in the case of the aerobic spore population which increased steadily over the period tested. Similar results were obtained in clean room B.

2. Studies were initiated at a local manufacturing plant (D) to determine the level of microbiological contamination to which spacecraft components are subjected during routine assembly operations. Several hundred rejected items of one type of transistor were obtained and heat sterilized. The sterile transistors were then given to various assembly personnel who performed simulated assembly procedures. One of the two groups wore finger cots. The results showed that there was a wide range in the levels of contamination deposited on components among the personnel. Each individual, however, appeared to have consistent deposition levels. It was evident that a device as simple as a finger cot significantly reduces the amount of contamination deposited on a component.

3. Exploratory studies also were initiated on the effect of storage on levels of natural contamination. In one series of tests sterile stainless steel strips were handled by laboratory personnel before and after hand washing. One portion of the strips were immediately assayed for aerobic microorganisms and another was allowed to stand in sterile bottles for one week and then assayed. The results obtained to date indicate that storage alone is able to reduce significantly levels of human microbiological contamination. These and other preliminary studies also show that in most cases the deposition of contamination on components is of a much higher level after handwashing. These results seem to parallel those from studies on shedding of organisms conducted at the Mayo Clinic and by the Biophysics Section.

   Several studies also were initiated to determine the effect of storage on airborne microorganisms accumulating on stainless steel strips. Preliminary results suggest that the level of contamination under these conditions remain essentially the same after storage for 2 weeks in a sterile environment.

4. Studies were undertaken to evaluate several reports during the past 5 years which indicate that viable microorganisms could be detected in 50 mg portions of activated carbon after autoclaving or dry heat cycles up to 1000° F. Results of studies at Phoenix showed that sterilization of activated carbon is accomplished at the normally accepted autoclaving cycle of 121° C for 15 minutes. Dry heat treatments of 165° C for 3 hours and 135° C for 24 hours also rendered activated carbon sterile. The difficulty involved in the sterilization of activated carbon by autoclaving, as experienced by other investigators, is the use of cotton-plugged tubes rather than screw-capped tubes. It was found that the cap, tight or loose, prevented steam from coming into complete contact with the activated carbon. The type of tube did not affect sterilization by dry heat.